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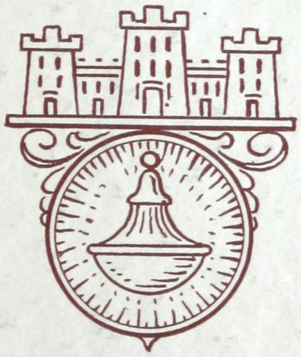
THE LIGHTING OF SCHOOLS

A GUIDE TO GOOD PRACTICE



THE LIGHTING OF SCHOOLS

A GUIDE TO GOOD PRACTICE

BOOKLET NO. 344-A

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HOLOPHANE COMPANY, INC.
342 MADISON AVENUE, NEW YORK
Works: Newark, Ohio

NEW YORK SAN FRANCISCO TORONTO

INTRODUCTORY

WHILE much has been written on the subject of school lighting, there has been lacking a presentation of the subject fitted to serve as a trustworthy and convenient guide to those who have the responsibility of choosing the school lighting system—the school architect, the school board, and the school administration. Such a presentation should be concise, yet thorough and complete; specific in its recommendations of equipment to be used, yet sufficiently disinterested to point out frankly whatever qualities of excellence competitive products may possess; simple and non-technical in its form of presentation, yet embodying and in accordance with the best technology of the subject.

We have endeavored to make this booklet conform to these views. How well we have succeeded must be decided by the verdict of those who accept the offered guidance and judge it by the lighting results thereby attained. We await that verdict with confidence, a confidence arising not from conceit but from a consciousness of how sincerely we have endeavored to apply the philosophy,

"He Profits Most Who Serves Best"

HOLOPHANE COMPANY, INC.

The Schoolhouse in which Nathan Hale Taught

More Light for the Modern School

GOOD artificial lighting is one of the most important factors in teaching. This fact is so patent that it is surprising that school boards have only commenced to appreciate its importance. Unwarranted increase in educational cost has aroused widespread interest and national surveys conducted by disinterested organizations indicate that the greater expense is partially caused by backward pupils afflicted with defective eyesight caused by the woefully inadequate lighting systems in the classrooms, study rooms, laboratory and other parts of the school, where the eyes of the pupil and teacher are in constant use.

Illumination engineers have ascertained that the lighting of many of our school buildings is inferior to that obtained in commercial and industrial establishments. This is truly an alarming condition because good lighting is just as important in the school as in the store, shop or factory. It must be remembered that if the eyes of the young child are subject to undue strain that faulty vision in later life will surely result. Teachers know that defective eyesight is the cause of frequent absence and low scholarship.

Recent surveys have shown that as high as 25% of American school children have defective eyesight. Enormous losses in time and money result from this condition, and these losses will continue if a remedy is not supplied. Needless to say, poor school lighting can be remedied—must be remedied, for it is false economy to erect costly educational edifices equipped with the most modern appointments in all departments except illumination, when it is so necessary to *see* in order to *learn.*

Many people will say that modern school buildings are equipped with large windows to provide maximum daylight. Measurements will show, however, that the light decreases as the distance from the window is increased, and the result is that the rows of desks farthest away from the window receive little light on cloudy days. Moreover, the direction of the light may create dark, annoying shadows in contrast to the sunlight. In every school where the artificial lighting is insufficient or poorly planned, much time is lost by teachers and pupils in the early morning and late afternoon hours of winter and in any season during cloudy weather.

Weather Bureaus state that there are but 107 to 110 really clear days out of the entire 365 in latitudes such as that of New York City. Natural daylight for school purposes is thus inadequate much of the time. Therefore, if the working efficiency is to be maintained the deficiencies of daylight must be overcome by providing adequate artificial illumination. How this can be done will be illustrated and explained in the following examples of good lighting, and the equipment which has been found most satisfactory to this end will be described hereafter.

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What Are the Essentials of Good School Lighting?

The modern school is used for many other purposes than reading and writing. Sewing, drafting, chemical experiments and the like are a regular part of the curriculum of modern schools. The lighting in these departments of the school *must* be adequate. The lighting of lunchrooms, washrooms, lockers, cloak rooms, corridors, etc. should provide sufficient but not excessive illumination. But the crux of the school lighting problem is the classroom where so many hours are spent and where the lessons are taught. Lighting the classroom and other important parts of the school to be efficient and safe must properly combine all of the following elements:

Sufficient Intensity

Sufficient intensities for the school are those which are conducive to accurate vision. These will vary, of course, according to specific requirements. On page 5 will be found tables showing the intensities of illumination which engineers recommend as best for different parts of the school.

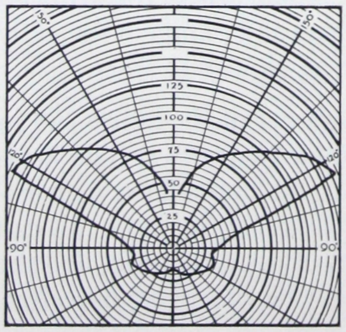
Reasonable Uniformity

The maximum variation in horizontal illumination as measured on the darkest and lightest desk in the room should not exceed 2 to 1. Even better uniformity than this will be secured with a well designed system. Uniformity of 1.2 to 1.0 is considered excellent. There are two reasons why the illumination should be uniform. From an economic standpoint the available flux of light should be allocated equally to each pupil. Also the eye functions better and without undue strain when stimulated by uniform illumination.

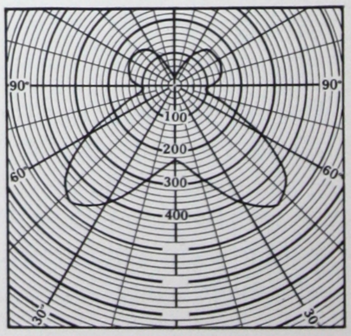
Proper Distribution and Glare

Perhaps the least understood attribute of any lighting installation is proper distribution. Briefly, the ideal light distribution would produce equal illumination on both horizontal and vertical surfaces. Now, the most effective light for the illumination of vertical surfaces is light emitted from the unit at angles near the horizontal. Likewise, it is light in these angles (60 degrees to 90 degrees) which causes glare. It is therefore necessary to effect a compromise by reducing the light flux in the 60 degrees to 90 degrees zone to the lowest obtainable minimum consistent with proper illumination for vertical surfaces. In a direct lighting system this means that from zero to 60 degrees illumination should be emitted in increasing proportion, then sharply reduced up to 90 degrees and then again allowed to pass. In a semi-indirect lighting installation the main flux should come from above the horizontal at wide angles and very little light should be emitted in the 60 degrees to 90 degrees zone.

Note how well the two distribution curves below conform to the ideal light distribution described above.



Characteristic Distribution Curve of Holophane Filterlite Semi-Indirect Unit.



Characteristic Distribution Curve of Holophane Reflector-Refractor Direct Lighting Unit.

Color Value

The Mazda Lamp Manufacturers are constantly working toward improvement in the color of the light emitted by the incandescent lamp, each improvement being toward a whiter light. It is important, therefore, that the reflector which surrounds the lamp should not alter the color of the light. Holophane Reflectors are unique in that the color of the light, after reflection or transmission, is unaltered in color value. The blue rays that are so important in satisfying the color balance in the eye and in effecting quick adaption to intensity changes are not absorbed as is the case with many other luminaires.

Depreciation

*Contrary to general opinion Holophane reflectors are less subject to temporary depreciation from dust and dirt than other reflectors. The Holophane Filterlite has the lowest dust and dirt depreciation of all enclosing lighting units. Not only do Holophane reflectors suffer only slightly from temporary depreciation but they have no permanent depreciation.

Quality

The term *quality* of illumination has been used to designate the integrated effect on the eye of glare, color of light, diffusion, uniformity of illumination and pleasing appearance of the lighted room. *Quality* of illumination, while somewhat vague as regards exact definition is in the last analysis perhaps the most important attribute to satisfactory school lighting. The quality of illumination accounts for the fact that in two class rooms, one having an illumination intensity higher than the other, the one having the lower illumination intensity may be the more satisfactory from the standpoint of ultimate effect on the eyes' sustained seeing ability. Holophane engineers have made and are still making exhaustive studies of the factors contributing to *quality* of illumination and their relative effect on the eye.

Desirable and Minimum Illumination on the Work

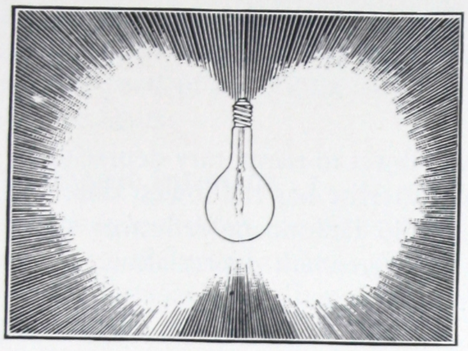
	Recommended foot-candles
Auditoriums, assembly rooms	3
Auditoriums, assembly rooms, etc., if used for class or study purposes	10
Classrooms, study rooms (desk tops)	10
Classrooms, study rooms (charts, blackboards)	6
Libraries (reading tables, catalogues)	10
Libraries (bookshelves, vertical plane)	6
Laboratories (tables, apparatus)	10
Manual training rooms, workshops, etc.	10
Drafting rooms, sewing	15
ON THE SPACE	
Walks, drives, and other outdoor areas, if used at night	0.5
Playgrounds, outdoor, if used at night	2
Playgrounds, outdoor, if used at night for baseball, basketball, etc.	10
Storage spaces, passages, not used by pupils	2
Boiler rooms, power plants, and similar auxiliary spaces	3
Stairways, landings, corridors, aisles, exits, elevator cars, washrooms, toilets, locker spaces, dressing-rooms	3
Recreation rooms, gymnasiums, swimming-pools	7

The degree to which a surface is illuminated is measured in foot-candles. One lumen will light a surface of 1 square foot to an average intensity of 1 foot candle. A lumen is the unit of light flux quantity measure.

*Data to substantiate these statements will be sent on request.

How to Control Light

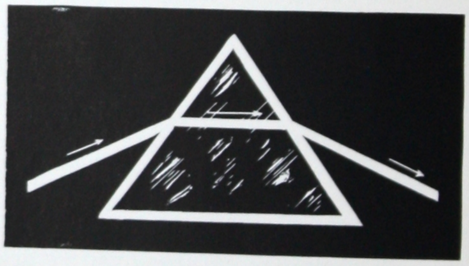
The necessity for employing school lighting units of scientific design has been outlined. The reasons why Holophane Prismatic School Lighting Units produce well-distributed and diffused light without glare will be explained and the different types of scientific lighting units available listed and described for the benefit of School Boards wishing to improve the lighting of institutions under their jurisdiction. In order to arrive at a clear understanding of the functions of lighting units, let us first consider the bare lamp, the incandescent electric bulb itself. This, the source of light, is exceedingly extravagant of light. It spends itself in a prodigal uncontrolled manner; its rays are projected to all points.


Light Distribution of the Bare Lamp

Bare lamps are rarely used today except by those ignorant of the nature of scientific illumination and the injury resulting to eyes exposed to such raw light. On the other hand, many accessories, fixtures and shading materials used in schools today are poorly designed and incapable of satisfactorily directing light. Many ordinary glass globes for example do not redirect light to any extent. They merely diffuse or scatter it. Half of the light still goes upward from the globe in an uncontrolled manner and the downward half is unwisely distributed.

Holophane Units Scientifically Correct

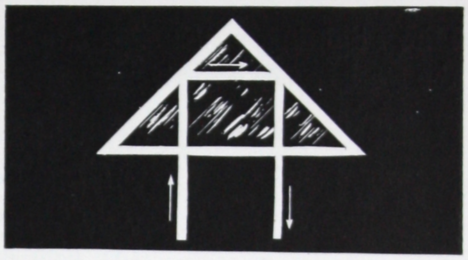
The most exact means known to science for controlling the direction of light is the glass prism. When a ray of light enters or leaves a glass prism it is bent at the surface of the glass prism in an angle depending on the angle of the prism and the angle of striking the glass. There are definite physical laws which govern these angles of light ray bending (refraction).


Prismatic Refraction

Holophane engineers are constantly originating novel and useful specifics for school lighting, employing the prisms above described. Careful and precise engineering and manufacturing together with continual research to determine the requirements, enables Holophane to produce prismatic specifics unequalled in efficiency.

By varying the shape of a prism and its relative position to the lamp filament, light can be directed to any desired direction. The prism can be made to bend the light rays so that they travel directly backward or the direction can be changed slightly or otherwise regulated anywhere between these two extremes.

Take the lighting problem involved in school corridors. Although it is relatively more important that school corridors be scientifically lighted than those of other buildings, yet the school corridor is most often in virtual twilight. Fractious pupils are more likely to become unruly in dimly lighted corridors than in well lighted ones. There is the element of safety as in case of fire or accident. Holophane has a prismatic unit available for corridor lighting which is especially designed for the purpose. Instead of forming circles of light of limited area with shadows outside the circumference, the Holophane corridor lighting units lay down merging ellipses of light, which are ideally designed to meet the physical configuration of the corridor itself.



Prismatic Total Reflection

Well-known to science are prisms which turn almost all of the light rays back in the opposite direction. This is called total reflection.

The bending of the light ray as it passes from air into glass or from glass into air is called *refraction.* The bending of the light ray directly back on itself is called *reflection.* Holophane makes a series of prismatic Light Directors for school lighting which utilize the scientific principles discussed and due to the inherent efficiency of prismatic light control and low dust and dirt depreciation, the cost over the life of the installation is without rival for economy.

The Holophane engineering principle is that each lighting installation is deserving of special study and consideration. Holophane engineering specifications are drawn on this basis, so that the equipment is selected for specific application.

On the following pages of this booklet are reproduced examples of good school lighting. Study them carefully, and if the lighting of your school does not seem to be equally effective, communicate with us, and we shall be pleased to send a capable illuminating engineer to check the lighting—and render you a complete report as to adequacy. This Better School Lighting Service is offered gratis.

Reflection Factors of Walls and Ceilings

It is highly important that the reflection value of different colors used for decorating school interiors be understood. These influence to a great degree, the type of lighting equipment necessary for illuminating interiors to reasonable intensities. The following table indicates the wide variation in the amount of light reflected from colored surfaces.

Approximate Percentage of Light Reflected

Color	*Percentage of Reflected Light*	*Color*	*Percentage of Reflected Light*
White	80	Buff	59
Cream	72	Light Blue	55
Ivory	70	Dark Tan	55
Yellow	67	Gray	40
Light Green	67	Dark Green	30
Pink	60	Dark Red	27

General Methods of Distributing Light

1. Direct Lighting

Direct lighting, as the name implies, is that in which practically all of the light that falls on the work comes directly from the luminaire. This type of lighting is usually characterized by

(a) High utilization efficiency
(b) Low depreciation.
(c) Comparatively sharp shadows.
(d) Poor uniformity (unless carefully designed).
(e) Glare is usually in evidence.

The Holophane Reflector-Refractor is a direct lighting luminaire and is designed to give a comparatively high indirect component so that shadows are fairly soft. Special attention has been given to the candle power distribution so that uniformity is excellent and glare is reduced to a minimum consistent with high utilization efficiency.

2. Indirect Lighting

Indirect lighting is the type where all the light that falls on the work comes from the ceiling as a secondary source. This type of lighting is excellent from all standpoints except that the illumination on vertical surfaces (black boards) is deficient and the maintenance cost is extremely high. Indirect lighting often has a depressing effect.

3. Semi-Indirect Lighting

The Semi-Indirect System is a compromise between the Direct and the Indirect System and can be made to combine the advantages of each without their inherent defects. The Holophane Filterlite is an example of the best that the lighting industry has to offer in semi-indirect lighting. The Filterlite has the following characteristics:

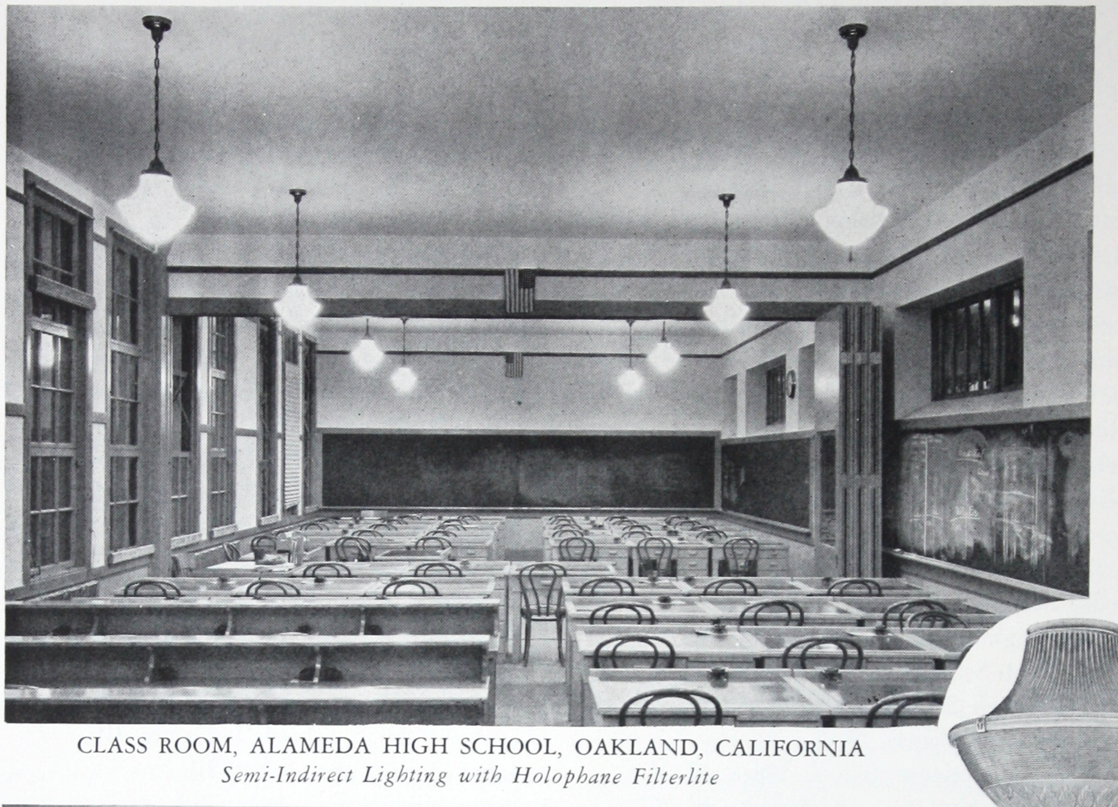
(a) High utilization efficiency (not as high as with the Holophane Reflector-Refractor).
(b) Very low depreciation.
(c) Soft shadows.
(d) Excellent uniformity.
(e) No glare.
(f) Cheerful pleasing appearance of the lighted room.

Semi-Indirect Lighting Best

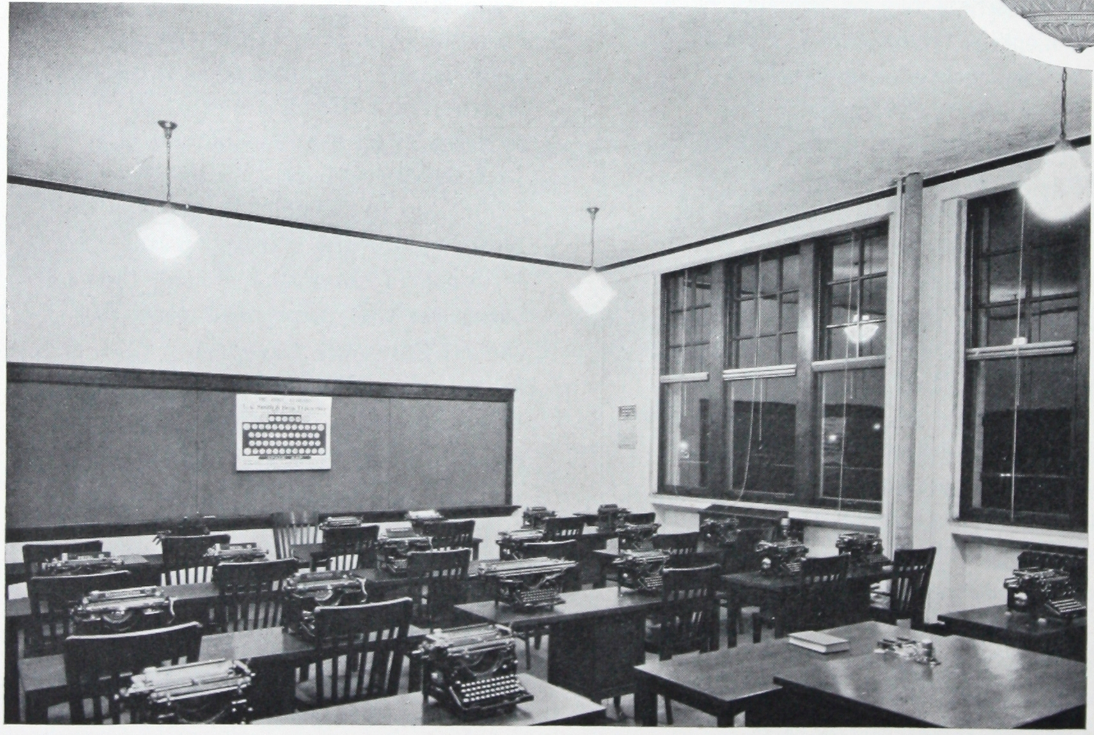
The semi indirect Holophane Filterlite system of illumination is unreservedly recommended for school class rooms because of its unrivaled quality and extremely low depreciation. While the energy consumption is approximately 35 per cent greater for the Filterlite than for the Reflector-Refractor for equal illumination intensity, the energy consumption based on equal seeing ability for both systems is approximately equal (see paragraph on Quality on page 5).

The following list of references is given so that the school board may visit one or more well lighted schools in their vicinity and see concrete examples of Holophane Scientific School Lighting.

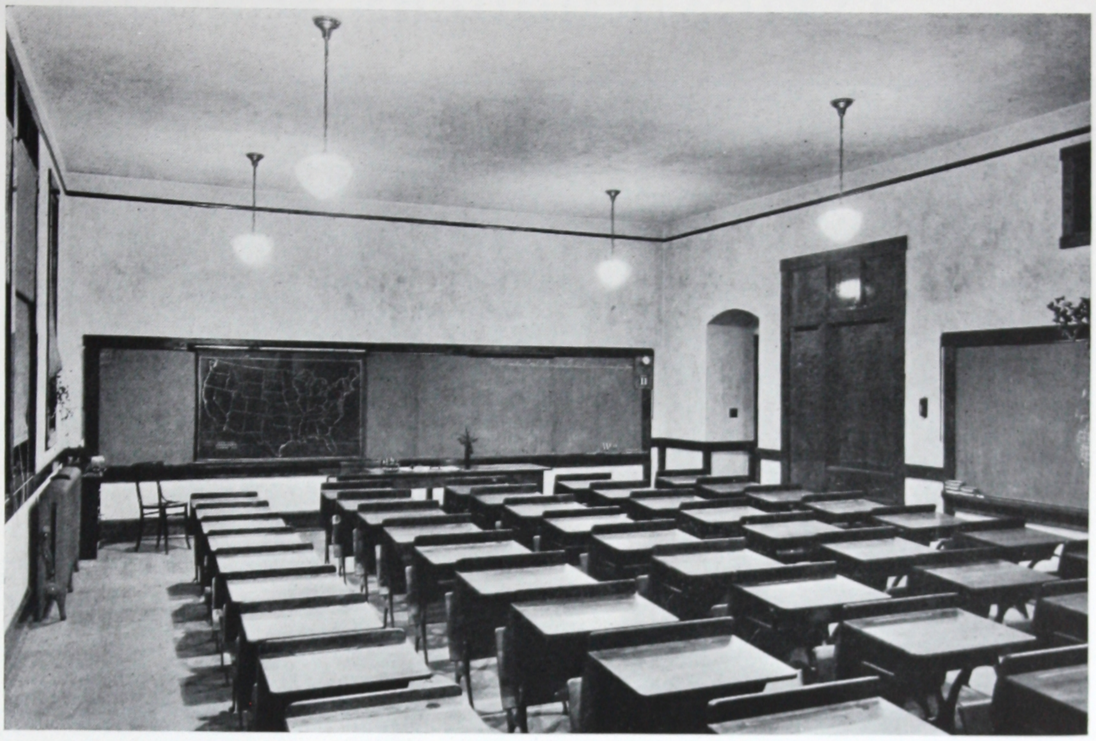
Harvard University, Cambridge, Mass.
Junior High School, Worcester, Mass.
Mechanical Arts High School, Springfield, Mass.
Mechanical Arts High School, Manchester, N. H.
Pawtucket High School, Pawtucket, R. I.
North Junior High School, New Bedford, Mass.
South Junior High School, New Bedford, Mass.
South Portland High School, South Portland, Me.
Public Schools, Central Falls, R. I.
Technical High School, Springfield, Mass.
Indian Orchard School, Springfield, Mass.
Waterside School, Stamford, Conn.
Carlisle St. School, New Haven, Conn.
Crosby School, Waterbury, Conn.
English High School, Waterbury, Conn.
Bristol High School, Bristol, Conn.
Hartford High School, Hartford, Conn.
High School, Syracuse, N. Y.
St. Anthony Convent School, Utica, N. Y.
Elementary School No. 68, Buffalo, N. Y.
Roscoe Conklin Grade School, Camden, N. Y.
Camden High School, Camden, N. Y.
Vare High School, Philadelphia, Pa.
Overbrook High School, Philadelphia, Pa.
Reading Public Schools, Reading, Pa.
DuPont High School, Wilmington, Del.
Baldwin School, Bryn Mawr, Pa.
North Dallas High School, Dallas, Texas.
Georgia Inst. of Tech., Atlanta, Ga.
Shorewood High School, Milwaukee, Wis.
Woodward School, St. Louis, Mo.
Fort Dodge High School, Fort Dodge, Iowa.
Waterloo High School, Waterloo, Iowa.
Alameda High School, Oakland, Cal.
Garfield School, Oakland, Cal.
Frank Wiggins Trade School, Los Angeles, Cal.
Alexander Hamilton Jr. High School,
Oakland, Cal.
Elmhurst School, Oakland, Cal.
Richmond High School, Richmond, Cal.
San Francisco School of Fine Arts,
San Francisco, Cal.
Salt Lake City Public Schools, Salt Lake City, Utah
Woodlawn High School, Birmingham, Ala.
Camden High School, Camden, N. J.
Ohio State University, Columbus, Ohio.
University of Cincinnati, Ohio.
De Pauw University, De Pauw, Ind.
Mt. Logan High School, Chillicothe, Ohio.
Roosevelt High School, Dayton, Ohio.
Convent Sisters of Precious Blood, Dayton, Ohio.
Jefferson High School, Dayton, Ohio.
Oakdale High School, Dayton, Ohio.
McKinley High School, Dayton, Ohio.
Lincoln School, Dayton, Ohio.
Harrison School, Dayton, Ohio.
Western Hills High School, Cincinnati, Ohio.
Public Schools, Kalamazoo, Mich.
Public Schools, Flint, Mich.
Oak Park High School, Chicago, Ill.
Lockport High School, Lockport, Ill.
Joliet High School, Joliet, Ill.
Pekin High School, Pekin, Ill.
Morengo High School, Morengo, Ill.
Cook County Township Schools, Chicago, Ill.
Aquine High School, Freeport, Ill.
Alvernia High School, Chicago, Ill.
La Salle High School, La Salle, Ill.
Wilmette City Schools, Wilmette, Ill.
New High School, Winnetka, Ill.
Milwaukee Continuation School, Milwaukee, Wis.
Marquette University, Milwaukee, Wis.
McGill University, Montreal, P. Q.
St. Aloysius Public School, Montreal, P. Q.
Dalhousie University, Halifax, N. S.
Oshowa Public Schools, Oshowa, Ont.
Windsor & Walkerville Technical School,
Windsor, Ont.
Sarnia Collegiate Institute & Technical School,
Sarnia, Ont.
Dunville Public School, Dunville, Ont.
Renfrew Collegiate Inst., Renfrew, Ont.
Public School, Mimico, Ont.
Riverside Public School, Port Credit, Ont.
High School, Port Credit, Ont.



CLASS ROOM, ALAMEDA HIGH SCHOOL, OAKLAND, CALIFORNIA
Semi-Indirect Lighting with Holophane Filterlite



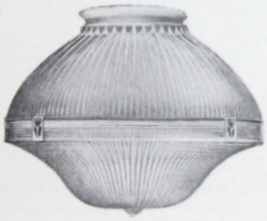
SHOREWOOD HIGH SCHOOL, MILWAUKEE, WISCONSIN
Semi-Indirect Lighting with Holophane Filterlite



CLASS ROOM LIGHTING, MILWAUKEE, WIS. HIGH SCHOOL

Direct Lighting with Holophane Reflector-Refractors

Lighting the Classroom



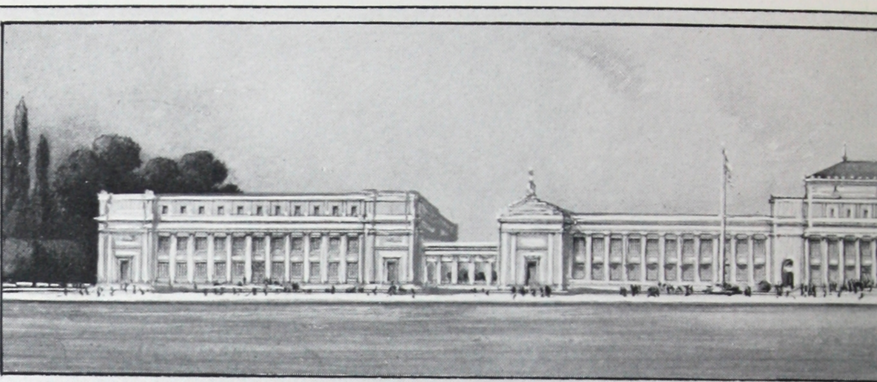
The uniform glareless illumination of high level in these classrooms* helps the students to be mentally alert and receptive. Every letter, every object, is clearly discernible and the school work performed with a minimum expenditure of nervous energy.

Holophane Engineering Service includes a painstaking study and analysis of the individual problems involved. No standardized formulas are alike applicable to all problems. The lighting unit must be carefully chosen and its application made to fit the type of light distribution necessary for the particular requirements.

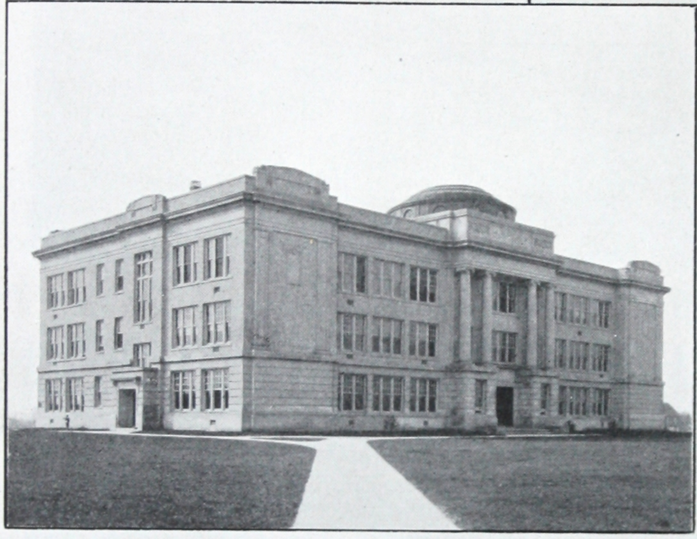
**The illustrations on the opposite page show classrooms illuminated by the Semi-Indirect Holophane Filterlite. The above illustration shows Direct lighting with Holophane Reflector-Refractors. The Filterlite is recommended for classroom lighting when the best is desired. If the first cost is of such importance as to sacrifice quality of lighting to some extent then the Holophane Reflector-Refractor is recommended.*

The class room is the most important floor area in the school and therefore deserves the best that science can give in the way of lighting. If economy consideration will not allow the best in the way of illumination for all parts of the building, then the class rooms should have first consideration and the part of the appropriation remaining should be pro-rated for the remaining space.

TYPICAL MODERN SCHOOLS LIGHTED W

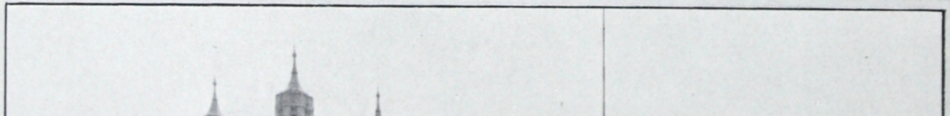


ALAMEDA HIGH SCH
The Largest Public



SHOREWOOD HIGH SCHOOL
Milwaukee, Wis.

THE JUNIOR HIGH SCHOOL
Worcester, Mass.



OVERBROOK SENIOR HIGH SCHOOL *Philadelphia, Pa.*

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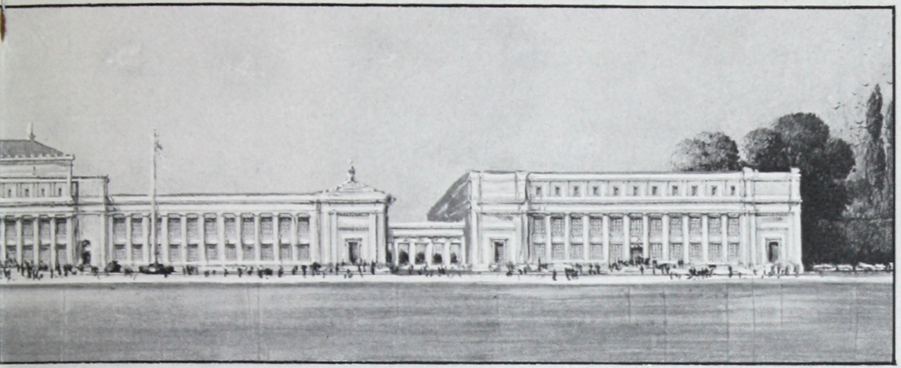
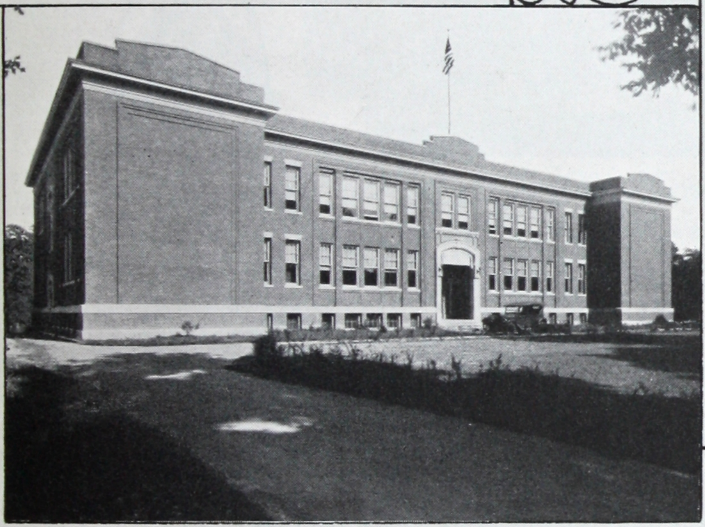
ITH HOLOPHANE SPECIFIC LUMINAIRES



OOL, OAKLAND, CAL.
School in the World



LOCKWOOD AVENUE SCHOOL
Stamford, Conn.

MILWAUKEE VOCATIONAL SCHOOL
Milwaukee, Wis.

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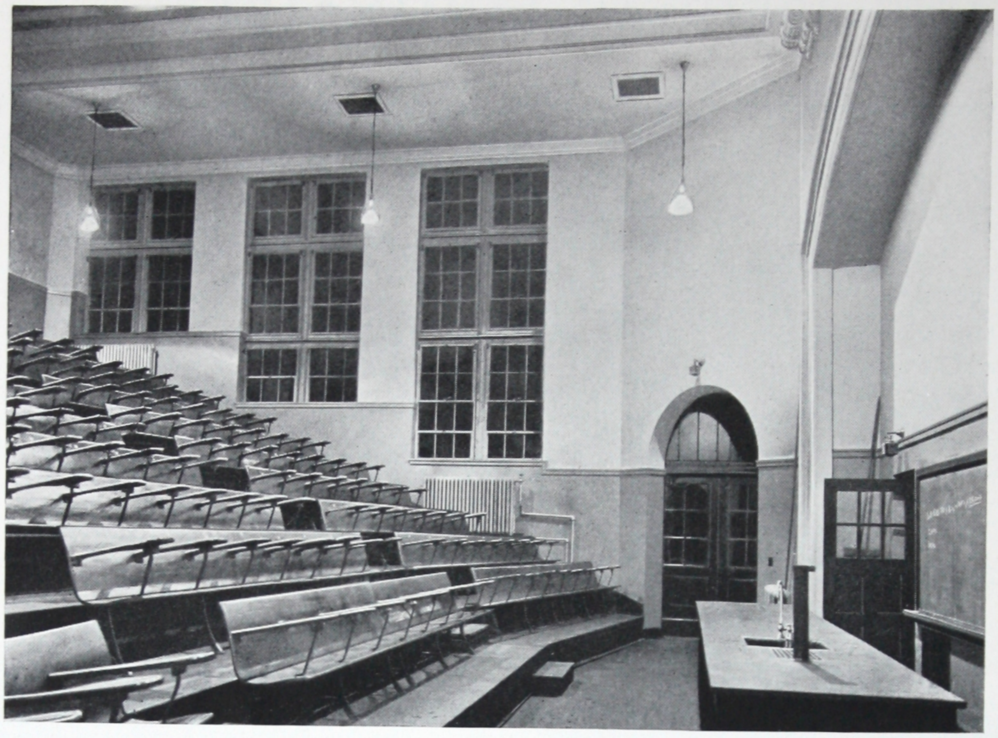
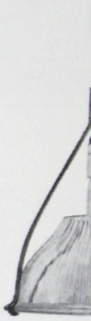
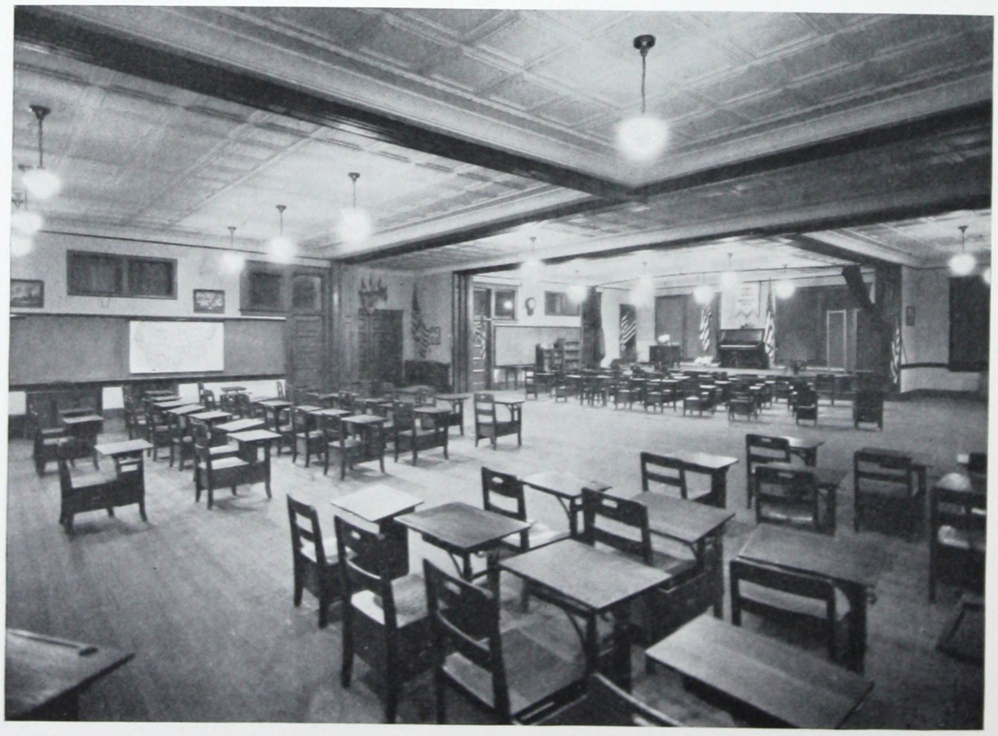
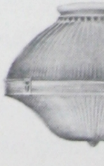
WATERSIDE SCHOOL, *Stamford, Conn.*



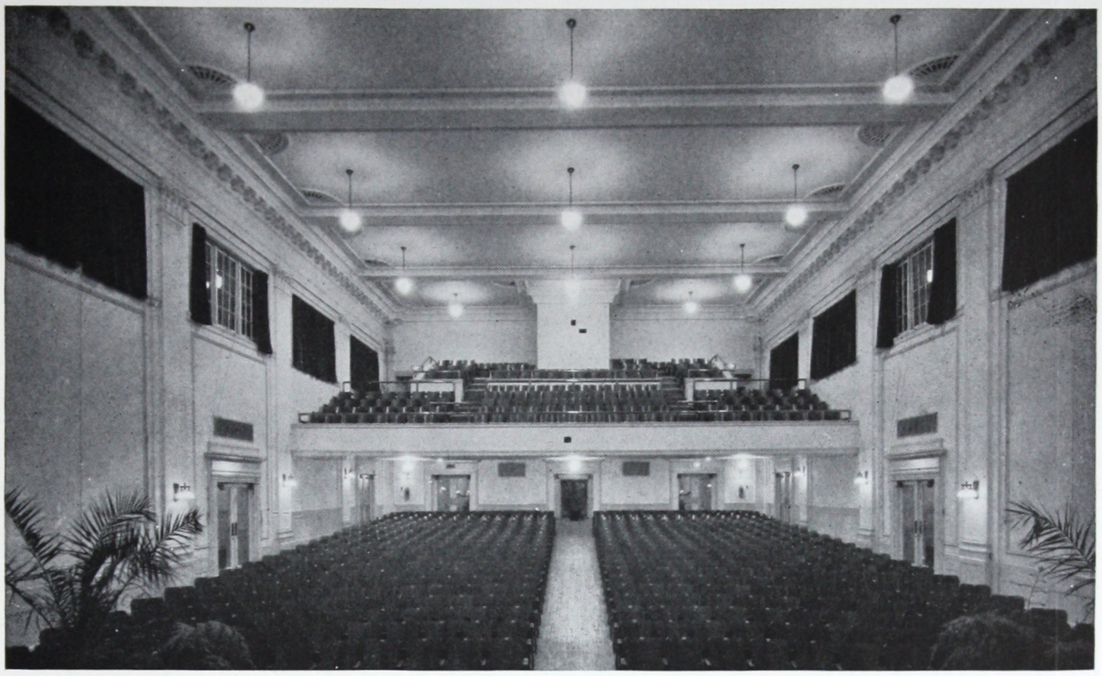


LECTURE ROOM, GEORGIA SCHOOL OF TECHNOLOGY, ATLANTA, GEORGIA
Direct Lighting with Holophane Unit No. 651



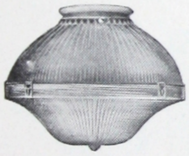


LECTURE ROOMS IN STAMFORD, CONN. SCHOOL
Direct Lighting with Holophane Reflector-Refractors



AUDITORIUM, VARE HIGH SCHOOL, PHILADELPHIA, PA.
Direct Lighting with Holophane Reflector-Refractors

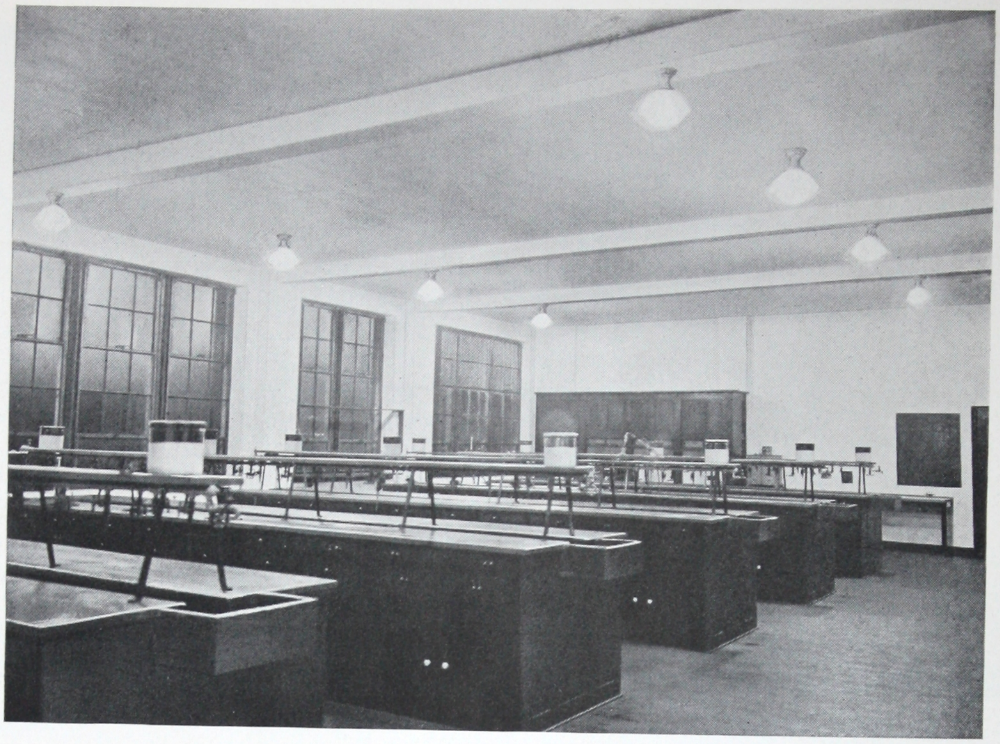
Lighting the Lecture Room and Auditorium

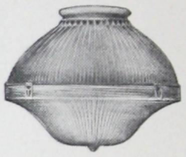


Pleasing appearance, freedom from glare, as well as a reasonable degree of illumination is needed in lecture rooms and auditoriums of schools. Holophane lighting equipment combines these essentials in a marked degree.

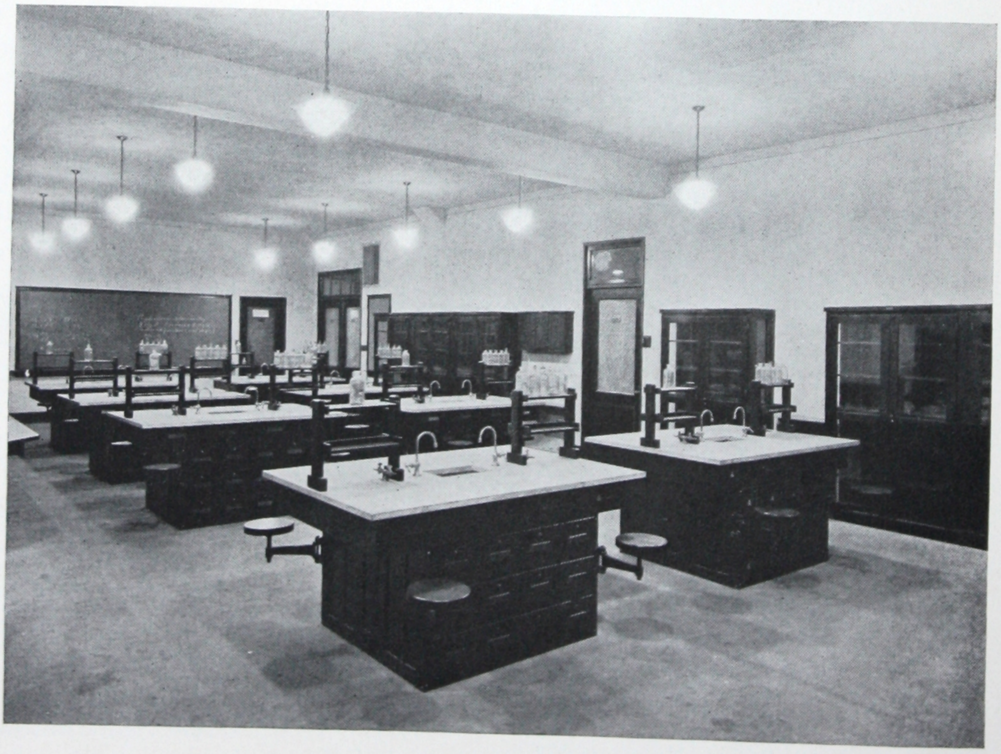
Lecture rooms and auditoriums in schools are used for a variety of purposes ranging from study rooms to theatres. For this reason the system of illumination should be flexible as regards intensity. In general, the illumination should be of the type required for class rooms with provision made for reducing the intensity when the space is used for theatre purposes. Special attention should be given to the possibility of glare in the eyes of those seated in the balcony and under the balcony. Special lighting equipment is required for the stage and the projection room. Adequate exit lighting must be provided.

Ability to read easily and without eye fatigue is assured *with* the Holophane Reflector-Refractor illustrated in the above insert, and hung according to the best practice as determined by the lighting engineers on our staff.

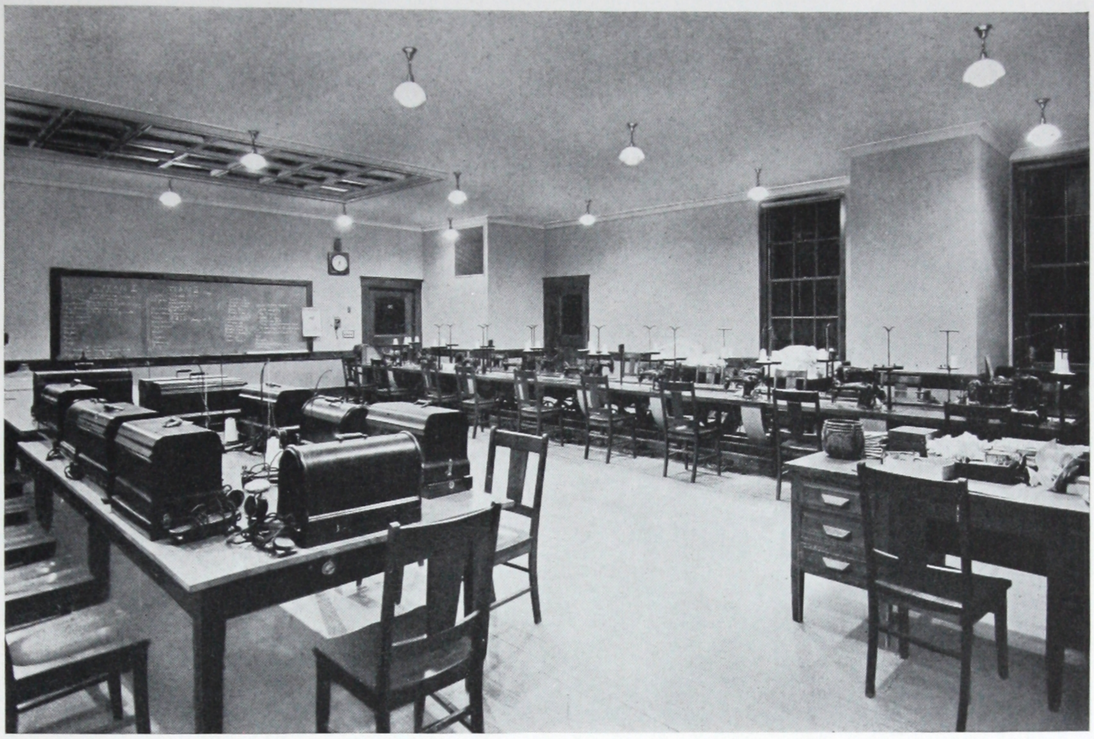




CHEMICAL LABORATORY, GEORGIA SCHOOL OF TECHNOLOGY, ATLANTA, GEORGIA
Direct Lighting with Holophane Reflector-Refractors

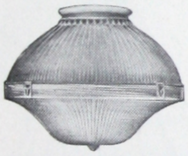


CHEMICAL LABORATORY, ROOSEVELT HIGH SCHOOL, DAYTON, OHIO
Direct Lighting with Holophane Reflector-Refractors



DOMESTIC SCIENCE ROOM, DAVID HALE FANNING TRADE SCHOOL, WORCESTER, MASS.
Direct Lighting with Holophane Reflector-Refractors

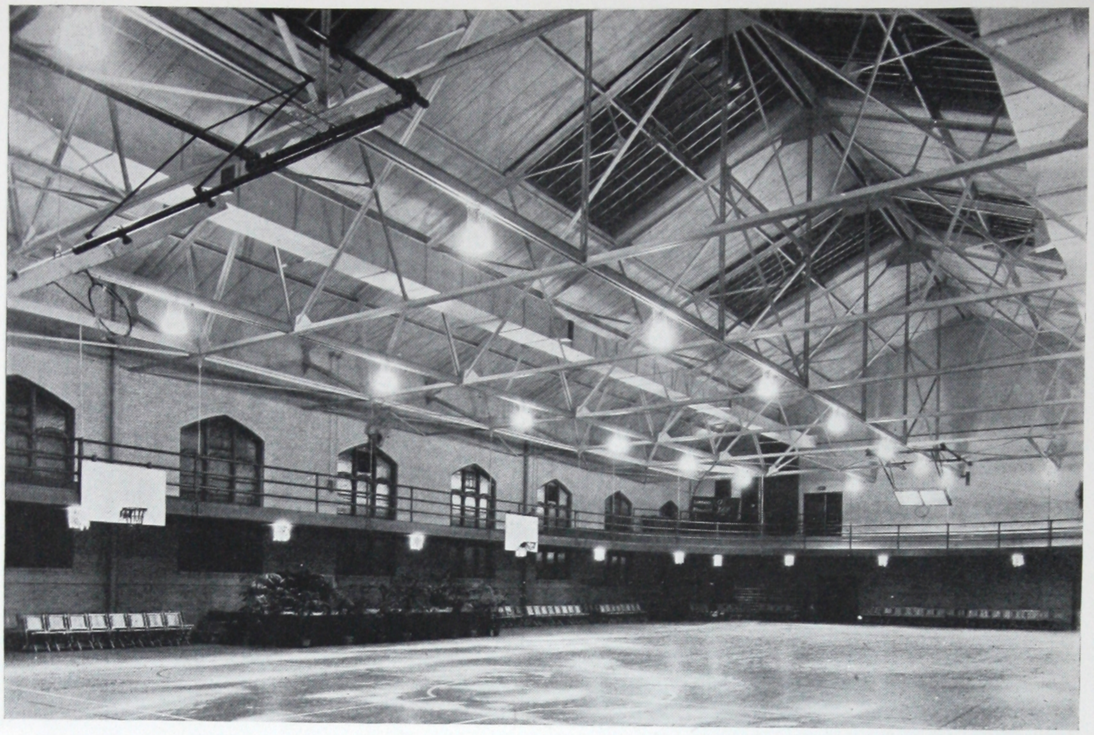
Lighting the Chemical Laboratory and Domestic Science Room



The Chemical Laboratory should be illuminated so that there will be a uniform high intensity of well diffused illumination of good color value. Special care should be taken in planning the Chemical Laboratory illumination so as to fulfill all the requirements. Sheen must be present so that shiny and glossy surfaces and flaky chemicals can be easily distinguished. This requirement is met only with directional light. Shadows should be reduced but not to the extent secured by the indirect or semi-indirect type of lighting. The color value must be such that slight differences in color, tint and shade can be distinguished as well as the true color of solutions, solids and precipitates. Added to these rigid requirements is that of slow depreciation under the action of acid and alkali gases and vapors.

The Holophane Reflector-Refractors and vapor-proof reflector globes are perfectly suited for this requirement, because of their high utilization efficiency, good diffusion, directional distribution, lack of selective absorption and the fact that the reflectors are not in the least subject to attack by acid or alkali gases or vapors.

The Holophane vapor proof reflector globes are extensively used in the acid, dye, and chemical plants which are in reality the enlarged commercial laboratory of the school. The Du Pont industries alone use several thousand of these units in their various chemical plants.

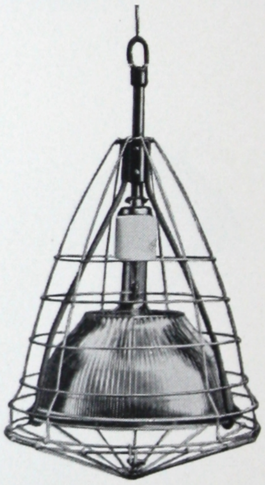


GYMNASIUM, MARQUETTE UNIVERSITY, MILWAUKEE, WISCONSIN
Direct Lighting with Holophane Gymnasium Unit

Lighting the Gymnasium

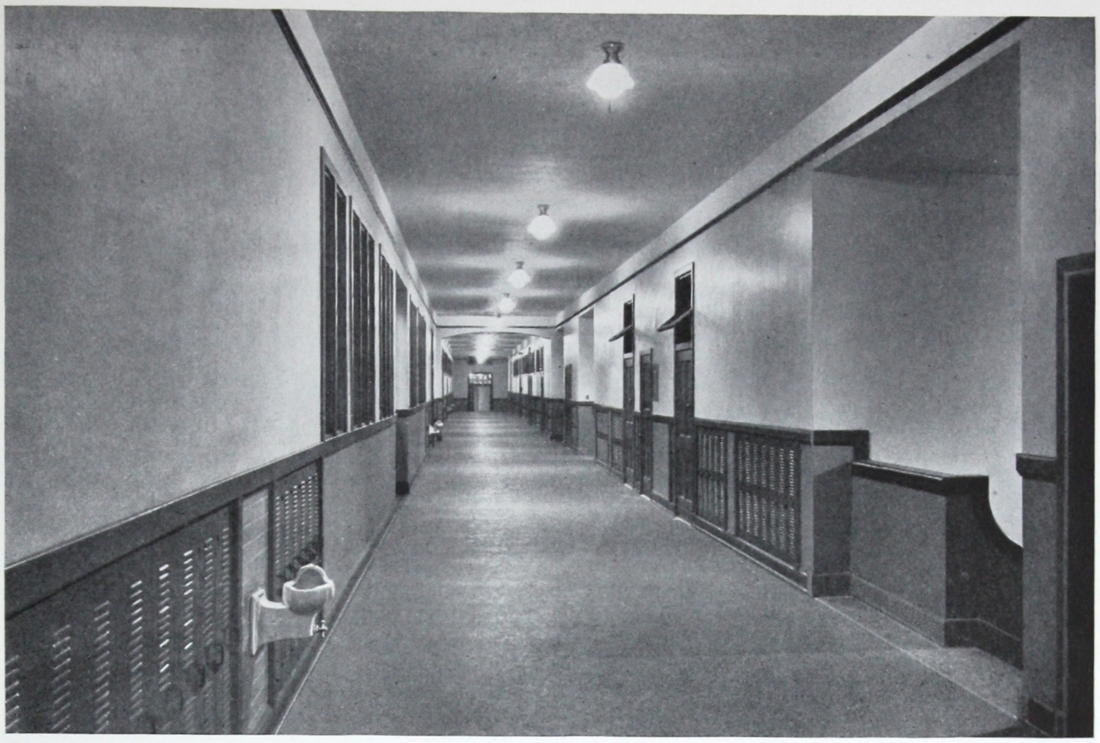
The home team is battling keenly for school and glory . . . the goal seems almost won . . . when a loud groan proclaims a costly fumble . . . a setback, and victory for the invaders.

How many know that faulty illumination is really to blame for the costly error? Yet glare or shadows everlastingly keep down the average results . . . be it in the classroom, the laboratory or the gymnasium.



Holophane Gymnasium Lighting assures students of the Marquette University that hard-fought contests will not be lost to them on account of poor lighting. The units are hung well out of the field of vision, obviating the possibility of blinding the eye, and yet turning all the rays of light downward to the plane where they are most needed.

Holophane has also designed special lighting equipment for large sports areas such as Indoor Baseball Cages, Outdoor Tennis Courts etc. Such equipment is in service in the Harvard and Yale University Baseball Cages.

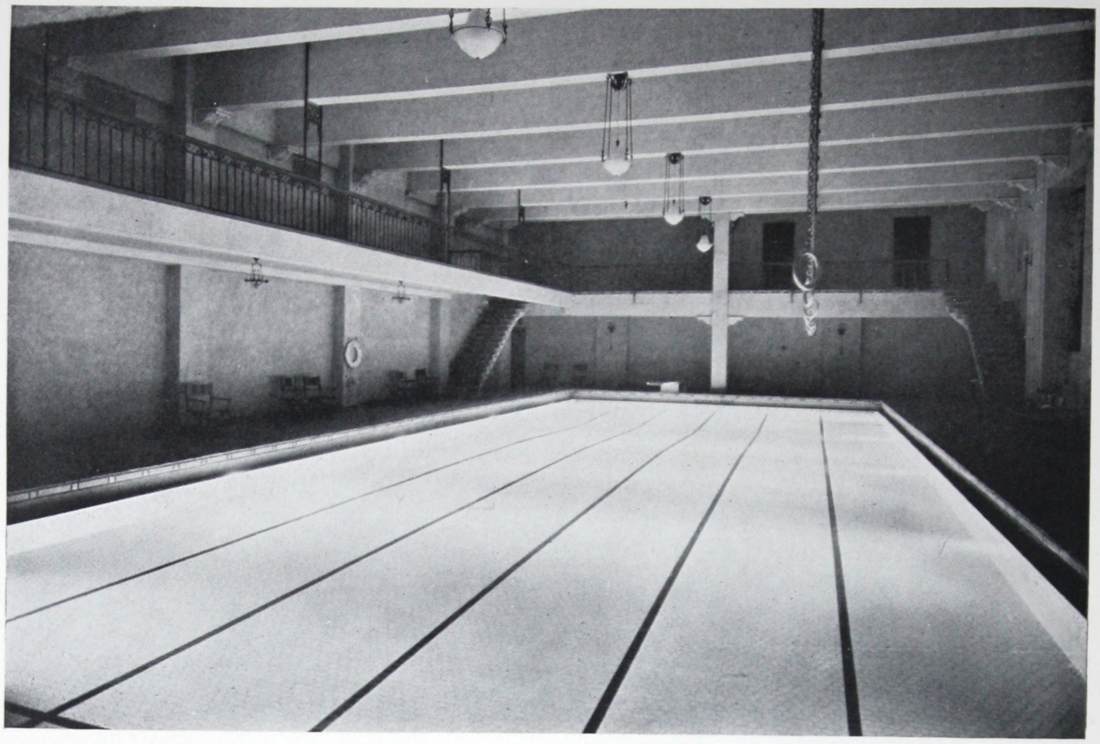


TYPICAL WELL LIGHTED CORRIDOR, ATLANTA, GEORGIA, HIGH SCHOOL
Direct Lighting with Holophane Corridor Unit, Asymmetric Type

Lighting the Corridor

Adequate, but not excess illumination is needed for lighting the corridors of schools. Personal hazard is reduced and discipline more easily maintained in well-lighted corridors than is possible when the light is dim or glaring. This corridor illustrates *specific* application. No general standardized unit which diffuses light haphazardly to the ceiling, walls and floor can equal in effectiveness Holophane Unit No. C-2172 which, by reason of its scientific prismatic construction lays down an ellipse of light on the corridor, thus making the illumination midway between lights uniform with that directly underneath a unit. In other words, there are no shadows or dark spots in Holophane Lighted School Corridors.

This Holophane specific for corridor lighting is an admirable example of how the ultimate distribution of light from the reflector is predetermined to give the desired lighting results. By allocating the available light flux properly every part of the area to be lighted is equally illuminated.



SWIMMING POOL, EAGLES CLUB, MILWAUKEE, WISCONSIN
Semi-Indirect Lighting with Holophane Filterlites (Not Lighted in Picture)
Auxiliary Under Water Illumination with Holophane Collector Plates No. 755

Lighting the Swimming Pool

The swimming pool should be lighted from overhead using a semi-indirect luminaire that will not glare directly in the swimmers' eyes, nor cause reflected glare from the surface of the water.

Auxiliary under water illumination should be provided so that the swimmer's body and the sides and bottom of the pool are lighted to an intensity at least as great as that of the exposed part of the swimmer's body and the walls of the pool room.

These requirements are admirably met with the Holophane Filterlite for overhead lighting and Holophane Collecting Plate No. 755.

The supreme center of interest in a swimming pool room is the pool itself and the swimmers therein. The effectiveness and attractiveness of a swimming pool will therefore be greatly enhanced if the sides and bottom of the pool and the bodies of the swimmers there are illuminated to an intensity many times greater than that of any of the other objects in the room.

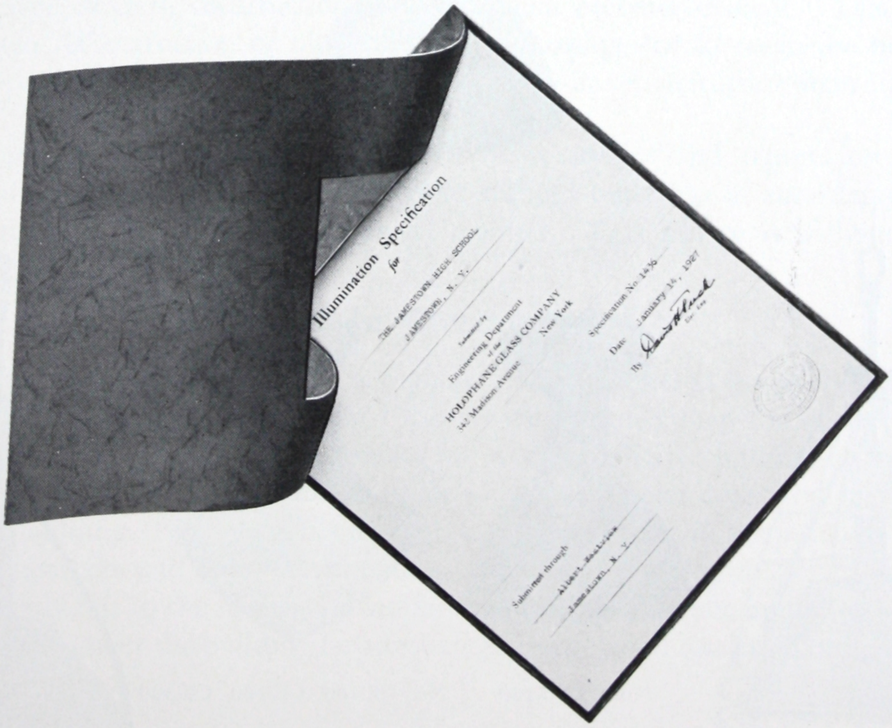
The Collecting Plates No. 755 are cemented into the sides of the pool flush with the surface and are arranged to project the light downward to illuminate the sides and bottom of the pool.

Engineering Service

On page 20 are shown cuts of various types of Holophane Reflectors that have special application to schools and on page 21 a list of the proper reflectors for each school location is given. It is of course impractical to show all possible conditions in a booklet of this size so the table and cuts on page 20 and 21 are to be used in a broad sense only. There are so many special conditions surrounding each school that it is much to be preferred to have the School Architect or School Board send a set of blueprints to our Engineering Department and have them go thoroughly into those determining factors that so often make a success or a failure of a School Lighting installation.

It has been our experience that it is only by the close co-operation of the Engineering Department of Lighting Fixture manufacturers and the School Architect or School Board that the best lighting system can be secured for the least cost.

The Holophane Engineering Department has prepared a great number of complete Illumination specifications covering the entire lighting of many of the finest schools in the country. These specifications show the intensity of illumination that will be received in the location, the number of reflectors required, the spacing of lighting units, the proper height above the floor for each reflector and the complete unit and total cost of the equipment.

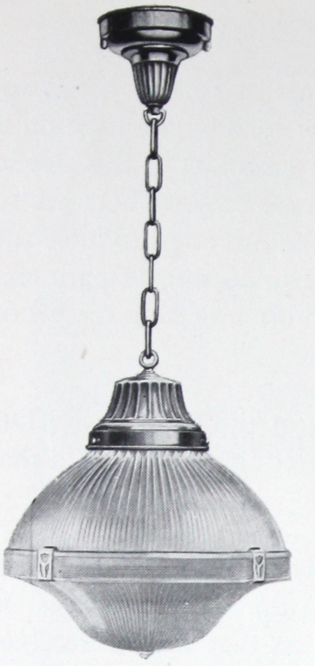


Illumination Specification
for
THE JAMESTOWN HIGH SCHOOL
JAMESTOWN, N. Y.

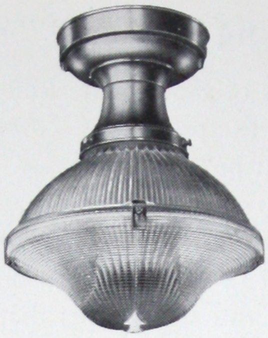
Submitted by
Engineering Department
of the
HOLOPHANE GLASS COMPANY
342 Madison Avenue New York

Specification No. 1436
Date January 14, 1927
By

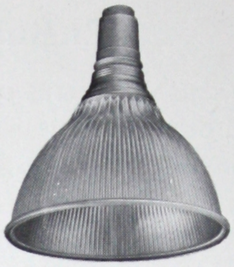
Submitted through
Albert [illegible]
Jamestown, N. Y.



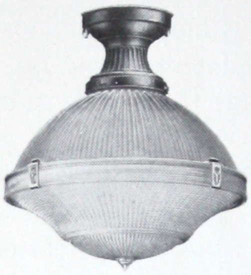
Nos. S-2110, S-2120, S-2130
S-2140, S-2170, S-2180



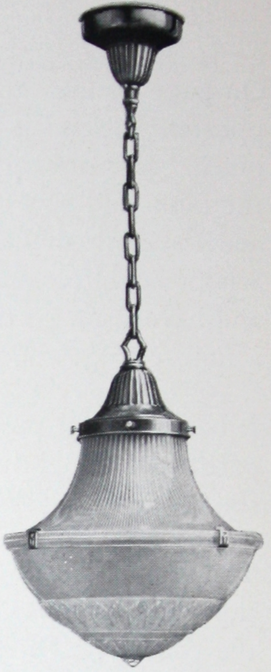
No. C-2172



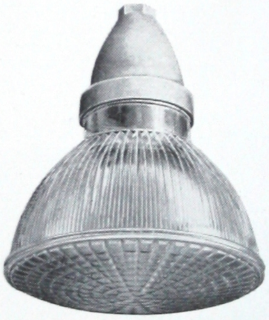
No. 6543



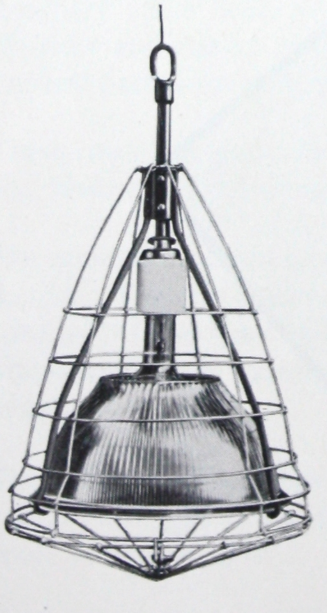
Nos. C-2110, C-2120, C-2130
C-2140, C-2170, C-2180



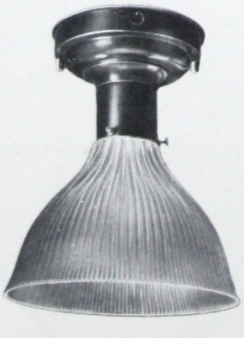
Nos. F-100, F-200, F-300, F-500



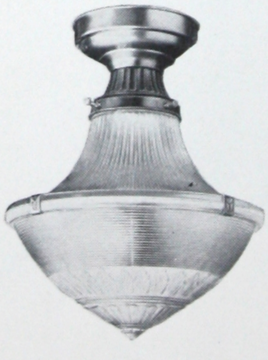
Nos. 02338, 02328



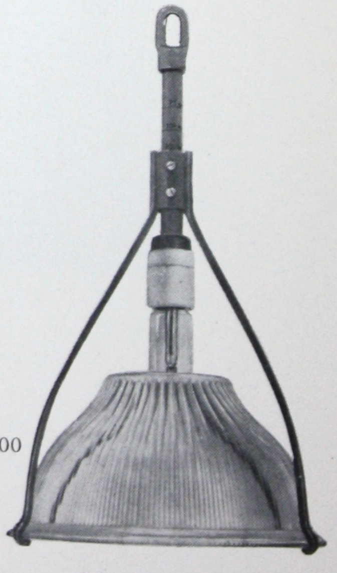
Nos. 621-G, 651-G, 661-G



No. CCSE-100



No. CF-100, CF-200, CF-300



Nos. 621, 651, 661

Location	*Wattage*	*Type of Holophane Unit (See page 20)*
Art Room	300	Filterlite (semi-indirect)
Auditorium	300-500	Reflector-Refractor (direct) or Filterlite
Cafeteria	100-200	Reflector-Refractor (direct)
Chemical Laboratory	200	Reflector-Refractor (direct)
& Physical Laboratory	200	or 02338
Class Room	200-300	Filterlite (semi-indirect) or Reflector-Refractor (direct)
Cooking Room	100-200	Reflector-Refractor
Corridors	75-150	C-2172 (direct)
Gymnasium	200-500	621-G or 651-G (direct)
Janitors Closets	50	Bare Lamp
Kitchen	100-200	Reflector-Refractor (direct)
Locker Room	100-200	6543 or CCSI (direct)
Manual Tr. Shop	200	621 or 6543 (direct)
Offices	200-300	Filterlite (semi-indirect)
Over Stage	200-500	621 or 651 (direct)
Sewing Room	200-300	Filterlite (semi-indirect) or Reflector-Refractor (direct)
Shower Baths	75-150	02328 (direct)
Stairs	100	Reflector-Refractor (direct)
Swimming Pools	300-500	*Filterlite (Semi-Indirect)
Toilets	75-100	CCSI (direct)

*Also under water illumination with Holophane No. 755 Collector Plate.

Reconstruction of Old Buildings

As new educational buildings are completed and compared to older institutions, the advantage of improved modern construction and equipment becomes evident. This has a tendency to hasten reconstruction of old buildings and equipment to reach the new modern standard of practice. There is no more important item in reconstruction than lighting.

The Holophane Engineering Department will make studies and reports on old school lighting installations and advise how to relight the old buildings in accordance with best modern practice and in the most economical manner. This service is without charge or obligation.

In Closing

It must be remembered that the school is a public building, erected for public benefit. The lighting in this edifice should be designed for efficiency, rather than for show. Therefore, it is wrong to vote an appropriation adequate for securing efficient lighting equipment, only to deduct 25% to 50% of this amount in order to place a pair of decorative lanterns on the outside of the building. This inevitably leads to unwise reduction in the purchase of lighting units for the classroom and other parts of the school where good lighting is a vital necessity. Likewise it is only fair to the health and welfare of the pupil that the appropriation for general lighting throughout the building be adequate to insure good results according to modern standards.

Holophane Publications

Bulletin No. 357-E ....Holophane Datalog
Bulletin No. 250................Scientific Street Lighting
Bulletin No. 350................Streets That Are Safe
Bulletin No. 357................4-Way and 2-Way Refractors
Bulletin No. 448................Industrial Lighting

In many Colleges, Universities, and intermediate Schools, Holophane publications are used as text and reference books in the regular Physics course.

Sample copies of any of the above publications will be sent on request without charge for such use. In quantity, any of the above are available to educational institutions at a nominal charge.